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A growing number of publications in the field of particle and dispersion science create an immediate need for a facilitated access by scientists to the latest relevant findings. An online monograph Topics in Particle and Dispersion Science (TPDSci.com) implements an original approach to this problem. This peer-review publication continually builds a comprehensive review from conclusion-oriented "very brief abstracts" (VBAs) as the building blocks. The review is complemented by an extensive concept-based Index and a free-form search as major components of the TPDSci navigation system.

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TPDSci.com: a continually updated monograph of selected topics in the optics of turbid media

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ABSTRACT

A growing number of publications in the field of particle and dispersion science create an immediate need for a facilitated access by scientists to the latest relevant findings. An online monograph *Topics in Particle and Dispersion Science* (TPDSci.com) implements an original approach to this problem. This peer-review publication continually builds a comprehensive review from conclusion-oriented "very brief abstracts" (VBAs) as the building blocks. The review is complemented by an extensive concept-based index and a free-form search as major components of the TPDSci navigation system.

Keywords: Internet information portal, online monograph, particle sciencc, dispersion sciencc, light scattering, optics of turbid media, VBA, TPDSci

1. INTRODUCTION

It is the role of a monograph to guide our study of a field of science by "marshaling evidence, calculating consequenccs and implications, and confronting counter-arguments and criticism."[1] However, the recent trends present new challenges to the scientific monograph, as well as to scientific publishing in general. Thcse trends include (1) progressing atrophy of the scientific monograph as we used to know it, and (2) disaggregation of traditional functions of the scholarly publishing.[2] This is compounded by a pressing need for efficient exchange of information on the current international research, voiced strongly in the light scattering community by T. Wriedt and J. Hellmers.[3,4] Thus, it is harder and harder for a scientist to be "up-to-date" within his/her discipline by using traditional "continucd learning" techniqucs, such as scanning a multitude of tables of contents of relevant journals.

We propose a novel approach to this complex problem, a re-invented monograph, which provides (1) a survey of the latest scientific developments in, and (2) a concise, yet increasingly comprehensive guide to selected fields of particle and dispersion science. This approach is implemented in an online monograph project *Topics in Particle and Dispersion Science* (TPDSci.com), which – within its broad and interdisciplinary spectrum – covers also major aspects of optics of turbid media.

2. A NOVEL CONCEPT – THE VBA

The TPDSci online monograph is modular in its structure. Its "review" part is composed of what we call "very brief abstracts" (VBAs), which are organized by an extensive (currently encompassing nearly 7,000 entries) hierarchical concept-based index and aided by a free-form search.

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The VBA is a concise, paragraph-long conclusion of a publication. It is written (preferably) by the author of an article and edited by a TPDSci editor. It stresses "what has been achieved" by the publication as opposed to "what has the publication author done" to achieve his/her results.

Since a publication may have several independent conclusions, it may be represented in TPDSci by several VBAs. In addition, more than one publication may be cited in the same VBA. The latter will be the case of publications drawing the same conclusion or contributing to a conclusion.

Let us look at the following example from TPDSci.com. In the *References* section of the website, one finds an article "Microsystems for optical cell detection: Near versus far field" published by S. Kostner and M. J. Vellekoop in 2008[5] (see Figure 5 in section 3). This publication is represented in the TPDSci monograph by three VBAs:

VBA (i): An optical flow-cytometer uses a DVD pickup to detect cells in a microfluidic system (Kostner S and Vellekoop 2008a).[6]

VBA (ii): Absorption of light by a cell can be deduced solely from the shape of the signal of a near-field projection flow-cytometer using a strip photodiode detector (Kostner S and Vellekoop 2008b, 2008a).[7]

VBA (iii): A near-field projection optical flow-cytometer using a strip photodiode detector detects, sizes, and differentiates between cells based on the shape of the detector signal (Kostner S and Vellekoop 2008b, 2008a).[7]

As one can see, the VBA (1) is focused on a specific, usually single scientific finding, and (2) is deliberately very concise. These two main features of the VBA as a modular building block of the monograph permit a significant flexibility in displaying its contents. This flexibility is intended to be fully exploited in a future release of TPDSci. Note that the latter two VBAs also refer to another article by the same authors listed in the *References* section of TPDSci.com, "Interpretation of projection cytometer signals for cell analysis."[8]. Hence, despite its similar name, the VBA is much different from a typical abstract of a publication.

Recognizing the importance of "finding content", TPDSci can be navigated in several ways, which will be illustrated in a forthcoming section of this article. Here, we would like to detail how publications and their VBAs are interrelated with the concept-oriented index of the monograph, a part of the navigation system of TPDSci. The following figure shows a snapshot of an index page of the TPDSci.com website citing articles by Kostner and Vellekoop.

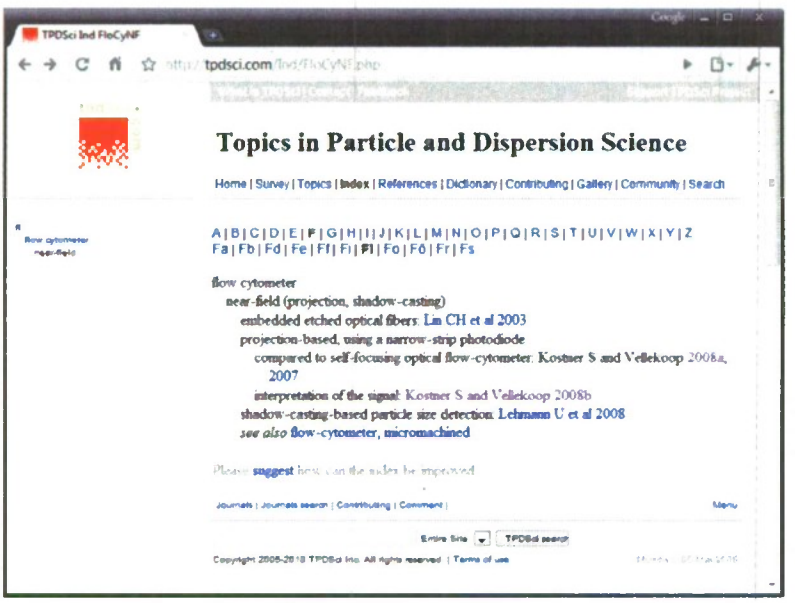

Figure 1. An index page of the TPDSci.com citing publications by Kostner and Vellekoop.

The index is intended to be a detailed guide (a navigational tool) to both the TPDSci content and publications cited in the TPDSci *References* section. However, its significance extends beyond the utilitarian function of such a tool and also beyond the utility a conventional book index. Indeed, the TPDSci index fulfills primarily the role of defining the structure of the science fields discussed in TPDSci. In short, within the framework underlying TPDSci, the index reports "what topics do publications discuss", while the VBAs report "what conclusions have that discussion reached."

The role of the index as a classification tool in TPDSci can be loosely compared to principal component analysis (PCA). Indeed, the TPDSci index reduces a huge dimensionality of the concept space ("semantic space"[9]) of a paper, which itself can be thought of as a collection of thousands of concepts. Like PCA, it replaces each massively multidimensional vector (a paper) of a data set (papers) with a few "principal components" of its projection onto a reduced-dimensionality reference frame (the index) that explains most of the variance of that data set. Hence, the index (concepts) and VBAs (conclusions) together attempt to capture the very essence of science discussed in the publications referred to by TPDSci.

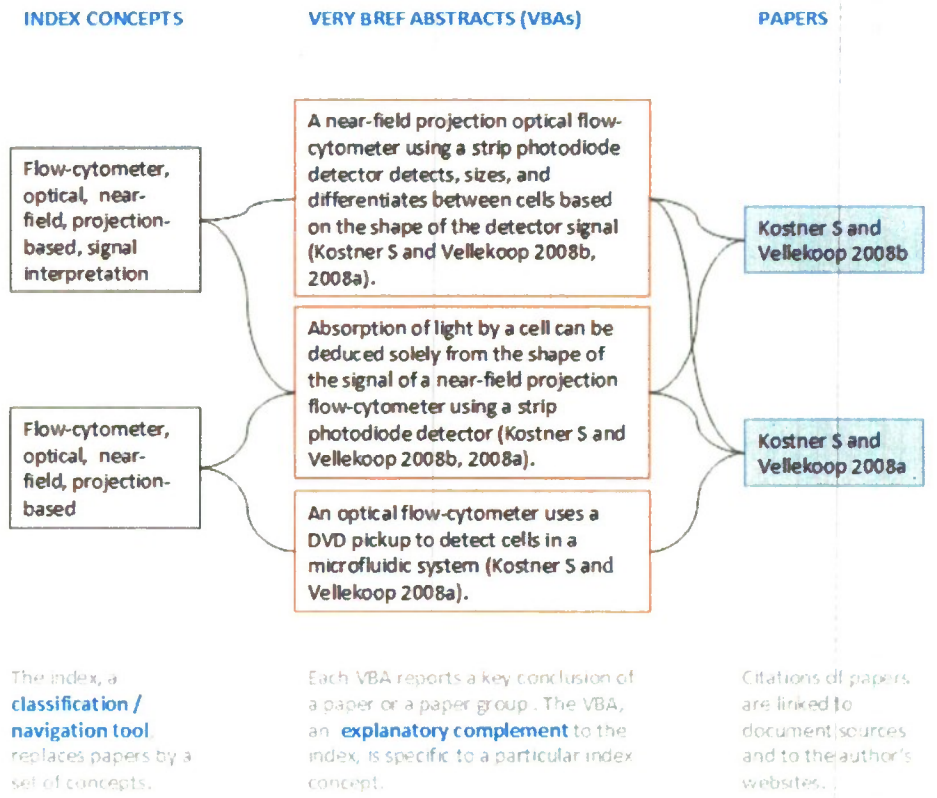

Figure 2. An illustrative example of the TPDSci framework: interrelationships between publications, their VBAs ("very brief abstracts"), and the concept-oriented index. Each concept of the index refers to a paper or to a group of papers (either directly, or via a VBA), i.e., it defines a sub-field of science.

A TPDSci index entry for a publication is generated manually as a result of a review of the publication, combined with suggestions of the author(s) of that publication. The index, presently implemented as a static tree, consists of paths starting at root terms (primitive concepts) and ending at the link(s) to publication(s) listed in the *References* section of the TPDSci.com, or to topical note(s) being a part of the *Topics* section of the TPDSci.com. An index path is referred to as an index concept in Figure 3.

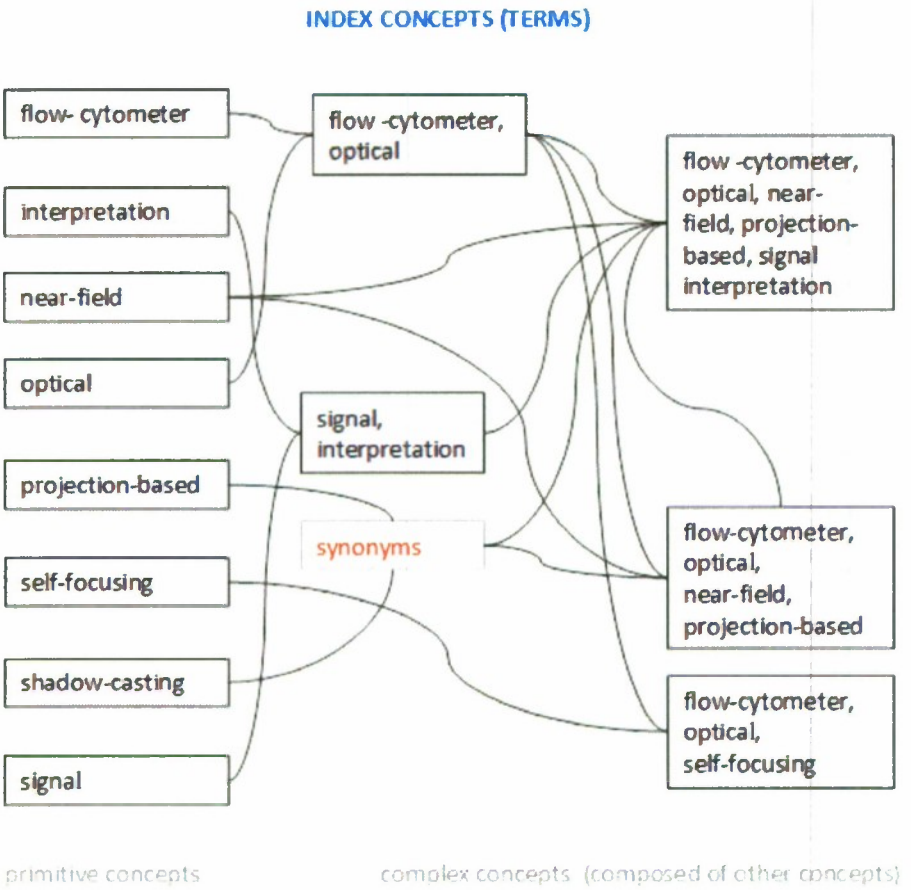

Figure 3. A schematic representation of the process of creating the concept-oriented index of the TPDSci.com. The index, a classification / navigation tool, "replaces" a paper by a low-dimensional set of concepts. This reduces the dimensionality of the "semantic space" of the paper which may be on the order of thousands of concepts.

As explained, the TPDSci index is generated by human experts. Nevertheless, on the "far side" of the future developments of our monograph, we envision combining generation of concepts by unattended analysis of scientific publications with those generated by human experts. Whether such automated generation will eventually replace the human expert is an open question that should, perhaps, be considered in the context of one of key functions of the scientific monograph, namely, a function of opening views on and identifying patterns in science. This function depends on a creative synthesis of results reported in many publications. As much as finding these publications in the world scientific literature has been greatly aided by the various search engines and abstracting services, the creative synthesis - along with the process of scientific discovery - are likely to remain the human domain for the foreseeable time.

3. NAVIGATING TPDSCI.COM

We would like to conclude our presentation of TPDSci.com by showing ways to navigate the website content, other than *via* its concept-oriented index.

Regular visitors of TPDSci.com will most likely start with the *Survey* section of the monograph, which provides them with VBAs presenting the survey of the recent literature on particle and dispersion science. Selected recent publications

are presented in both *Time-oriented* and *Field-oriented* forms of the survey. Samples of these survey forms are shown in Figure 4 and Figure 5.

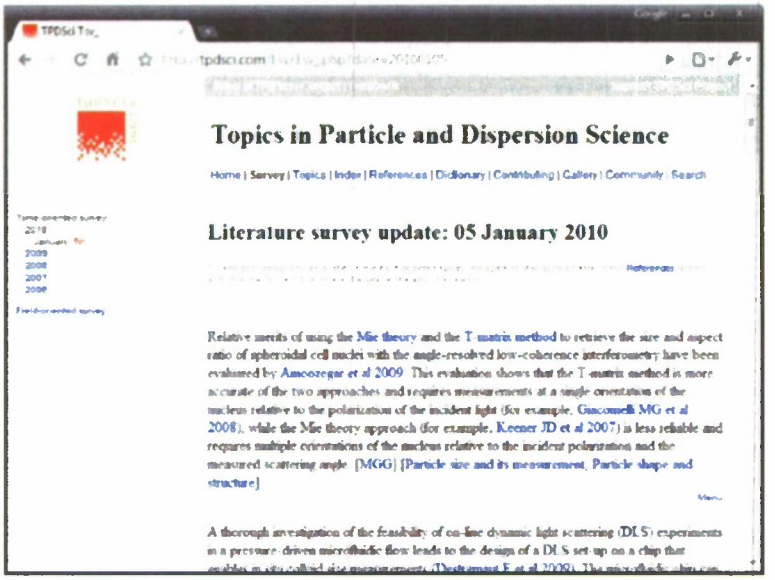

Figure 4. A sample webpage of the *Time-oriented* literature survey of TPDSci.com.

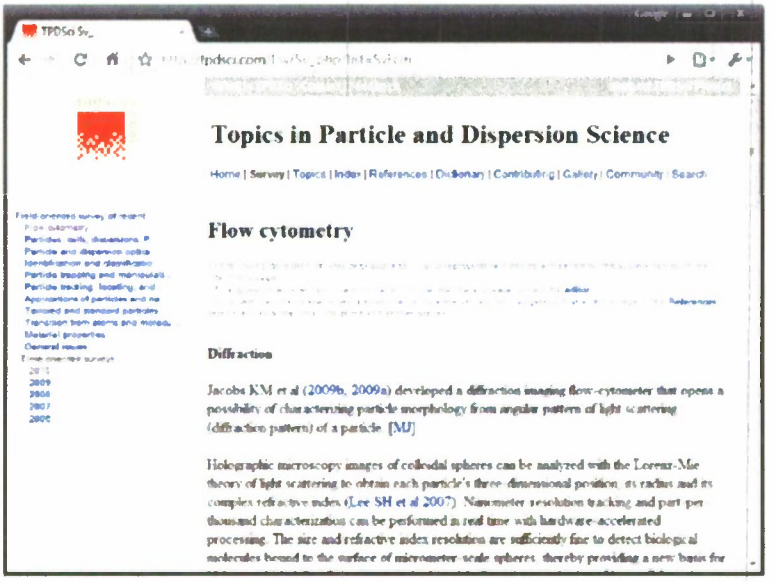

Figure 5. A sample webpage of the *Field-oriented* literature survey of TPDSci.com.

The *References* section lists over 3,000 publications cited in TPDSci.com. A sample *References* webpage is shown in Figure 6. Each citation links, if possible, to the website of a journal or a non-periodic publication (for example, a book) and to the publication source. If a PDF or other web-based document format of the publication is freely available, a link to that format is also provided. Finally, the citation also links to a VBA and/or a topical note (if available).

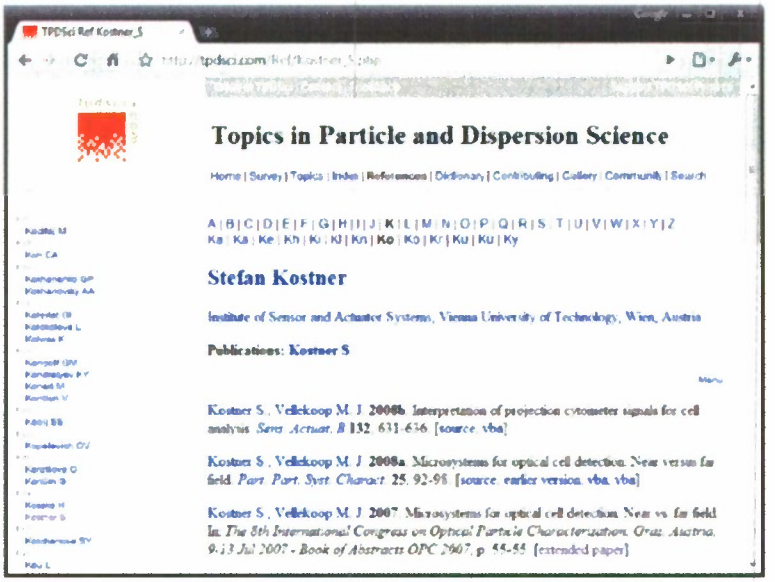

Figure 6. A sample webpage of the *References* section of TPDSci.com.

The *References* also serve as a community and expert contacts list by providing, where feasible, affiliation-contact information and links to personal webpages of the authors. Hence, along with the index - which defines "expertise areas" - the *References* section can be used to identify and contact experts active in those areas.

A visitor of TPDSci.com can also navigate the website via the table of contents of the *Topics* section (Figure 7), which is composed of a collection of topical notes and problems for classroom use. The topical notes are substantially cross-referenced short overviews (several-paragraphs long) of the respective subfields of science (topics) within the scope of TPDSci.

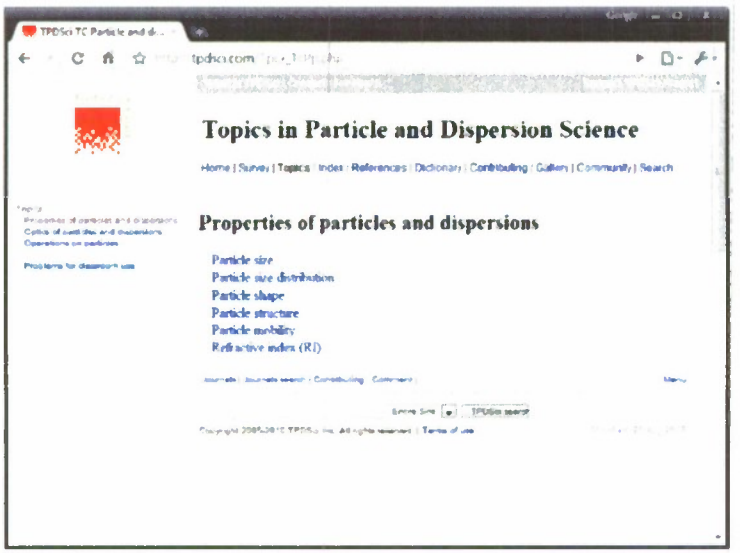

Figure 7. A sample navigation page (table of contents) of the *Topics* section of TPDSci.com.

4. CONCLUSIONS – FUTURE DIRECTIONS

The online peer-reviewed monograph project TPDSci.com is intended to help the scientific community in fast and efficient surveying of the current research findings within particle and dispersion science. We believe that the framework of TPDSci provides a novel approach to scientific monograph publishing by combining the development of a conceptual map of relevant science fields with conclusions regarding these concepts, as reported by scientific publications. These two key functions are implemented in TPDSci by the concept-based index and the conclusion-oriented very brief abstracts (VBAs).

A work-in-progress by definition, as science itself, the TPDSci website might evolve in several directions. We intend to focus the website development on improvements of the navigation, with a more intuitive/efficient browsing through the concept-oriented index. We also plan to exploit the modularity of the VBA-based approach to constructing a scientific monograph towards the customization of presentation of the monograph content tailored to a reader's specific scientific interests.

Finally, we are and we will continue encouraging an increasingly collaborative involvement in the TPDSci project from the broadly understood particle and dispersion science community. Hitherto, the list of the TPDSci topical editors and reviewers has 46 names. We envision that with a growing awareness of the TPDSci project, and with the recognition of its usefulness to the scientific community, the number of its active collaborators will also grow.

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